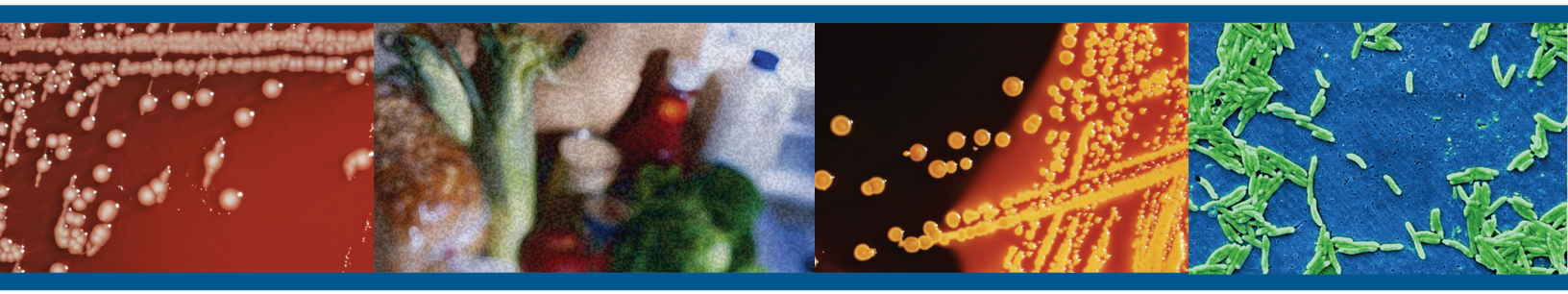
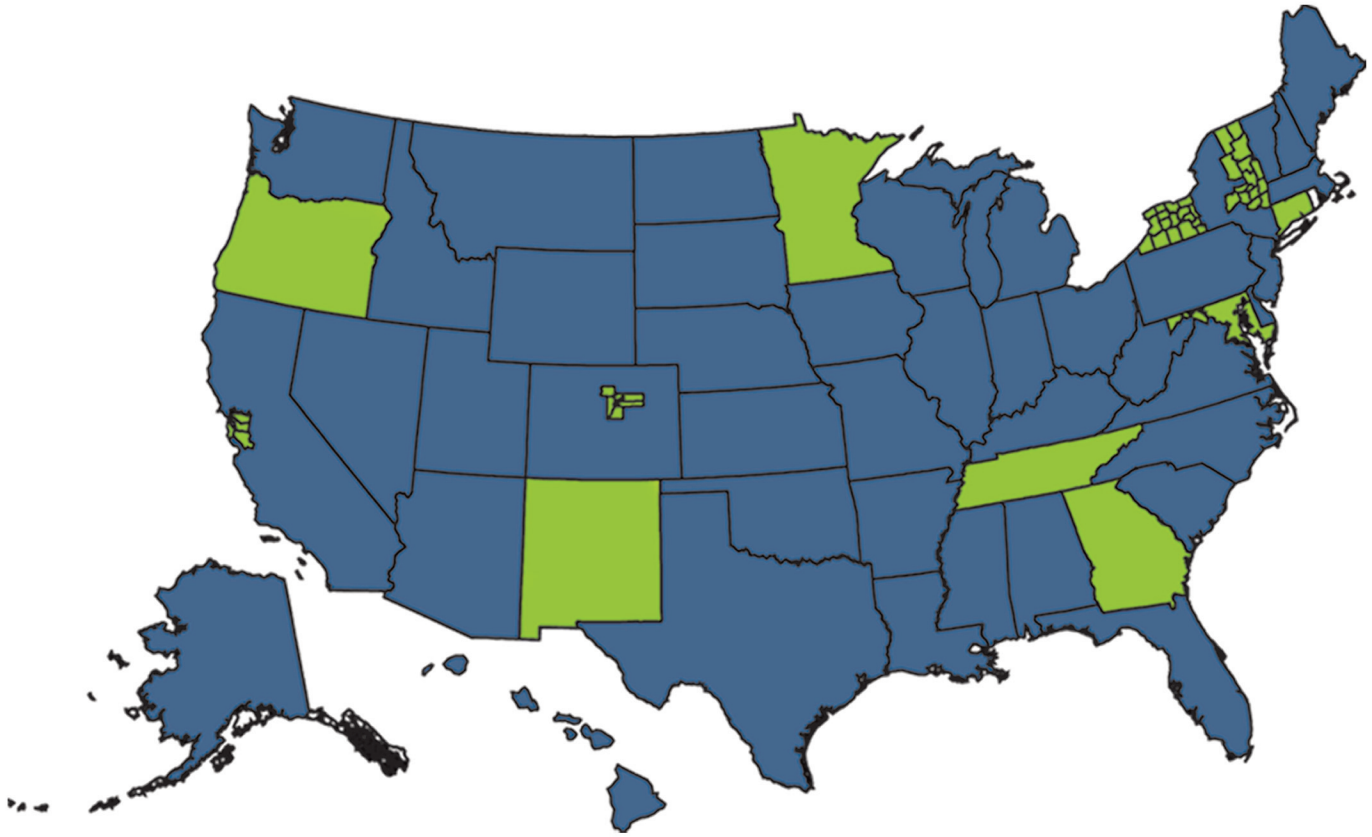
Foodborne Active Disease Surveillance Network (FoodNet)

Surveillance Report

2007





U.S. Department of Health & Human Services

Centers for Disease Control and Prevention

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Table of Contents

Page

Executive Summary

The Foodborne Diseases Active Surveillance Network (FoodNet) is the principal foodborne disease component of the Centers for Disease Control and Prevention's (CDC's) Emerging Infections Program (EIP). FoodNet is a collaborative project among CDC, ten state health departments, the Food Safety and Inspection Service (FSIS) of the United States Department of Agriculture (USDA), and the Center for Food Safety and Applied Nutrition (CFSAN) and the Center for Veterinary Medication (CVM) of the United States Food and Drug Administration (FDA). FoodNet is an active sentinel surveillance network designed to produce stable and accurate national estimates of the burden and sources of foodborne diseases in the United States through active surveillance and additional studies. This enhanced surveillance and investigation conducted by FoodNet are integral to developing and evaluating new prevention and control strategies to improve the safety of our food and the public's health.

In 2007, the FoodNet surveillance area included 45.9 million persons, or 15.2% of the United States population. FoodNet ascertained 18,039 laboratory-confirmed infections of *Campylobacter, Cryptosporidium*, *Cyclospora*, *Listeria, Salmonella, Shigella*, Shiga toxin-producing *Escherichia coli* (STEC) O157, STEC non-O157, *Vibrio* and *Yersinia*. Most infections were due to *Salmonella* (38%) or *Campylobacter* (33%). Infections were equally distributed between genders, and the highest incidence of infection with many pathogens occurred among children <1 year of age (173 cases/100,000 population). Twenty-one percent of the persons reported with infections were hospitalized, and 64 (0.4%) persons died. The greatest number of deaths occurred in persons with *Salmonella* infections. Five percent of cases were outbreak-related; of these, 54% were associated with foodborne outbreaks. A history of international travel was obtained for *Salmonella* and STEC O157 cases; 9% of *Salmonella* infections and 3% STEC O157 infections were related to international travel.

Compared with the 1996-1998 period, in 2007, the estimated incidence rates of *Campylobacter, Listeria, Salmonella, Shigella*, STEC O157, and *Yersinia* infections were significantly lower. However, most of the declines in the incidence of these infections occurred before 2007. Compared with the previous 3 years (2004-2006), the estimated 2007 incidence of *Campylobacter, Listeria, Salmonella, Shigella*, STEC O157, *Vibrio,* and *Yersinia* infections did not significantly change. The estimated 2007 incidence of *Cryptosporidium* infections was significantly higher compared with the 2004-2006 period.

The incidence of *Salmonella* infections substantially exceeds its national target for 2010. Of the most common *Salmonella* serotypes, only the estimated 2007 incidence of serotypes Typhimurium and Heidelberg infections decreased significantly compared with the 1996-1998 period. Compared with the previous 3 years (2004-2006), only serotype Typhimurium decreased significantly, while significant increases occurred in the reported incidence with infections of serotypes I 4,[5],12:i:- and Newport.

Due to the time required to complete hospital discharge data review for HUS cases, there is a one-year delay in the reporting of final HUS surveillance results compared with FoodNet active surveillance results. In 2006, FoodNet ascertained 109 post-diarrheal HUS cases. Ninety-three cases (85%) were reported in persons less than 18 years of age. Overall, the crude reported incidence rates of pediatric STEC O157 infection and HUS demonstrate a general correlation in trends

Background

Foodborne infections are an important public health challenge. In 1999, the Centers for Disease Control and Prevention (CDC) estimated that foodborne infections caused 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths each year. CDC, the Emerging Infections Program (EIP) sites, the Food Safety and Inspection Service (FSIS) of the United States Department of Agriculture (USDA), and the Center for Food Safety and Applied Nutrition (CFSAN) and the Center for Veterinary Medication (CVM) of the United States Food and Drug Administration (FDA) are actively involved in preventing foodborne diseases. In 1997, the interagency national Food Safety Initiative was established to address the public health challenge of foodborne diseases. CDC's principal role in the Food Safety Initiative has been to enhance surveillance and investigation of infections caused by pathogens transmitted commonly through food. The Foodborne Diseases Active Surveillance Network (FoodNet) has been the program primarily responsible for accomplishing this mission.

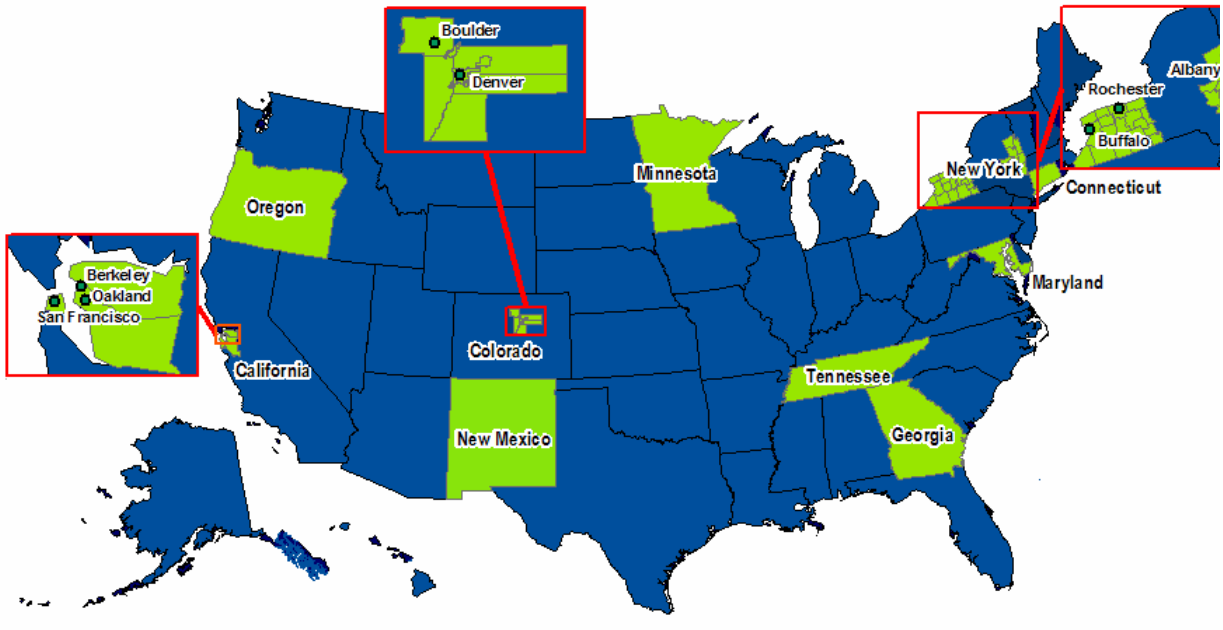
Objectives

The objectives of FoodNet are to determine the burden of foodborne diseases in the United States, monitor trends in the burden of specific foodborne illnesses over time; attribute the burden of foodborne illnesses to specific foods and settings; and develop and assess interventions to reduce the burden of foodborne illness. To meet these objectives, FoodNet conducts active surveillance and related epidemiologic studies. By monitoring the burden of foodborne diseases over time and attributing foodborne disease to specific sources, FoodNet can provide information to assess the effectiveness of new food safety initiatives, such as the USDA Hazard Analysis and Critical Control Points (HACCP) system, in decreasing the burden of foodborne disease in the United States.

Surveillance Area

FoodNet was established in 1996 and initially conducted population-based active surveillance in five sites; Minnesota, Oregon, and selected counties in California, Connecticut, and Georgia. By 2004, the FoodNet surveillance area had expanded to include 10 sites: Connecticut, Georgia, Maryland, Minnesota, New Mexico, Oregon, and Tennessee, and selected counties in California, Colorado, and New York (Figure 1). The FoodNet surveillance area in 2007 included 45.9 million persons, which represented 15.2% of the United States population (Table 1). The gender, race and ethnic distribution of the FoodNet surveillance population was similar to that of the United States population as whole, except for an under-representation of the Hispanic population (Table 2).

Figure 1. FoodNet surveillance sites, 2007



California: Alameda, Contra Costa, San Francisco

Colorado: Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson

New York: Albany, Allegany, Cattaraugus, Chautauqua, Chemung, Clinton, Columbia, Delaware, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Livingston, Ontario, Orleans, Otsego, Monroe, Montgomery, Niagara, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, Steuben, Warren, Washington, Wayne, Wyoming, Yates

Table 1. United States population under FoodNet surveillance, 2007

FoodNet Site	Population	%
California	3,248,818	7.1
Colorado	2,701,357	5.9
Connecticut	3,502,309	7.6
Georgia	9,544,750	20.8
Maryland	5,618,344	12.2
Minnesota	5,197,621	11.3
New Mexico	1,969,915	4.3
New York	4,267,305	9.3
Oregon	3,747,455	8.2
Tennessee	6,156,719	13.4
Total	45,954,593	
FoodNet population as percentage of U.S. population		15.2

Table 2. Comparison of FoodNet surveillance population to United States population, 2007

	FoodNet Surveillance population		United States population	
	N	**(%)**	**N**	**(%)**
Total population	45,954,593		301,621,157	
Gender				
Male	22,611,400	(49.2)	148,658,898	(49.3)
Female	23,343,193	(50.8)	152,962,259	(50.7)
Age				
<1	637,602	(1.4)	4,257,020	(1.4)
1-9	5,459,088	(11.9)	36,316,733	(12.0)
10-19	6,276,951	(13.7)	41,787,999	(13.9)
20-20	6,312,241	(13.7)	42,090,102	(14.0)
30-39	6,316,101	(13.7)	40,709,680	(13.5)
40-49	7,043,235	(15.3)	44,846,202	(14.9)
50-59	6,155,410	(13.4)	39,249,646	(13.0)
60+	7,753,965	(16.9)	52,363,775	(17.4)
Race				
Non-Hispanic white	31,391,142	(68.3)	199,091,567	(66.0)
Non-Hispanic black	6,941,857	(15.1)	37,037,204	(12.3)
Non-Hispanic other	3,048,982	(6.6)	19,988,075	(6.6)
Hispanic	4,572,612	(10.0)	45,504,311	(15.1)

Methods

FoodNet Active Surveillance

FoodNet conducts surveillance for all laboratory-confirmed isolations of *Campylobacter*, *Cryptosporidium*, *Cyclospora*, *Listeria monocytogenes*, *Salmonella*, Shiga toxin-producing *Escherichia coli* (STEC)—including STEC O157 and STEC non-O157—*Shigella*, *Vibrio*, and *Yersinia* infections in residents of the FoodNet surveillance area. A case is defined as isolation (for bacteria) or identification (for parasites) of an organism from a clinical specimen. For simplicity, in this report all isolations are referred to as infections, although not all strains of all pathogens have been proven to cause illness in humans. To identify cases, FoodNet personnel communicated with each of the 650 clinical laboratories serving the surveillance area either weekly or monthly, depending on laboratory volume.

Once a case is identified, FoodNet personnel at each site complete a set of core FoodNet variables and enter this information into an electronic database. Standardized definitions for hospitalization, patient outcome (alive or dead) and international travel are used. Hospitalization status in the seven days before or after specimen collection is noted. Patient outcome is recorded seven days after specimen collection, or if patient is hospitalized, at the time of hospital discharge. International travel within seven days of illness onset is captured routinely for all *Salmonella* and STEC O157 cases.

The number of FoodNet sites has doubled, and the population under surveillance has more than tripled, since FoodNet began in 1996 (Table 3). Because of the substantial variation in incidence of infection due to various pathogens among the sites, adding new sites in itself influences the overall crude incidence. To account for the increase in the FoodNet surveillance area and for variation in the incidence of infections across sites, a main-effects, log-linear Poisson regression model (negative binomial model) was used to estimate the statistical significance of changes in the incidence of pathogens over time (*1*). To create a comparison period, the average annual incidence of each pathogen for the FoodNet surveillance periods of 2004-2006 and 1996-1998 (1997-1998 for *Cryptosporidium*) was calculated. The estimated change in incidence (relative rate) between these comparison periods and 2007 was calculated, along with a 95% confidence interval (CI). Using the average incidence for a three-year comparison period, rather than the incidence in the single year of 1996, as in previous reports, yielded more stable and precise relative rate estimates.

1 Hardnett FP, Hoekstra RM, Kennedy M, Charles L, Angulo FJ; Emerging Infections Program FoodNet Working Group. Epidemiologic issues in study design and data analysis related to FoodNet activities. *Clin Infect Dis* 2005;38(Suppl 3):S121--6

Table 3. Population under surveillance, by site, FoodNet, 1996-2007

FoodNet Site	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
California	2,087,032	2,113,195	2,142,806	2,162,359	3,181,762	3,222,065	3,216,115	3,207,738	3,200,118	3,203,175	3,217,413	3,248,818
Colorado	-	-	-	-	-	2,155,950	2,508,240	2,531,078	2,559,719	2,594,899	2,644,648	2,701,357
Connecticut	1,622,809	2,453,483	**3,272,563**	**3,282,031**	**3,411,990**	**3,429,770**	**3,451,867**	**3,472,964**	**3,481,890**	**3,486,490**	**3,495,753**	**3,502,309**
Georgia	2,720,443	3,632,206	3,744,022	**7,788,240**	**8,230,919**	**8,422,127**	**8,591,169**	**8,740,008**	**8,921,371**	**9,107,719**	**9,342,080**	**9,544,750**
Maryland	-	-	2,441,279	2,450,566	2,516,588	4,244,743	**5,433,822**	**5,494,136**	**5,537,662**	**5,573,163**	**5,602,017**	**5,618,344**
Minnesota	**4,647,723**	**4,687,726**	**4,726,411**	**4,775,508**	**4,934,185**	**4,984,100**	**5,020,624**	**5,052,497**	**5,085,626**	**5,113,824**	**5,154,586**	**5,197,621**
New Mexico	-	-	-	-	-	-	-	-	**1,892,182**	**1,916,331**	**1,942,302**	**1,969,915**
New York	-	-	1,105,062	2,084,453	2,111,038	2,112,091	3,318,186	3,957,749	4,295,382	4,281,110	4,272,538	4,267,305
Oregon	**3,195,087**	**3,243,254**	**3,282,055**	**3,316,154**	**3,431,096**	**3,472,224**	**3,521,520**	**3,556,956**	**3,583,027**	**3,629,959**	**3,691,084**	**3,747,455**
Tennessee	-	-	-	-	2,826,127	2,859,308	2,889,526	**5,853,371**	**5,912,063**	**5,989,309**	**6,074,913**	**6,156,719**
Total	14,273,094	16,129,864	20,714,198	25,859,311	30,643,705	34,902,378	37,951,069	41,866,497	44,469,040	44,895,979	45,437,334	45,954,593
FoodNet population as percentage of U.S. population	5.4	6.0	7.7	9.5	10.9	12.2	13.2	14.4	15.2	15.2	15.2	15.2

Bold indicates active surveillance was conducted statewide, including all counties within a state; otherwise surveillance was conducted in select counties.

"-" Indicates state was not a FoodNet site during indicated year.

HUS Surveillance

FoodNet conducts surveillance for cases of hemolytic uremic syndrome (HUS). Active surveillance is conducted for pediatric HUS (persons younger than18 years of age at disease diagnosis) through a network of pediatric nephrologists and infection control practitioners who report all cases of HUS that they identify. FoodNet also conducts passive surveillance for adult HUS cases (persons 18 years of age or older).

In 2000, FoodNet sites began hospital discharge data review for pediatric HUS cases to validate HUS surveillance activities and identify additional HUS cases. HUS cases are identified using ICD-9 codes specifying HUS, acute renal failure with the hemolytic anemia and thrombocytopenia, or thrombotic thrombocytopenic purpura with diarrhea caused by STEC (or another unknown pathogen). The time needed for hospital discharge data review and validation of the HUS diagnosis through medical record reviews results in a one-year lag in complete reporting of HUS surveillance results compared with FoodNet active surveillance results.

Narrative Report

2007 Surveillance Results

Cases Reported

In 2007, FoodNet sites identified 18,039 laboratory-confirmed infections caused by the pathogens under surveillance. Of 16,801 bacterial infections, most were caused by *Salmonella* (41%), followed by *Campylobacter* (35%), *Shigella* (17%), STEC O157 (3%), STEC non-O157 (2%), *Yersinia* (0.98%), *Listeria* (0.73%), *Vibrio* (0.65%), STEC O Antigen Undetermined (0.07%), STEC O Antigen Rough (0.04%),and STEC O Antigen not tested (0.01%) (Table 4A). Of the 922 cases of parasitic infections, 99% were caused by *Cryptosporidium* and 1% by *Cyclospora* (Table 4B).

Of 6,447 (94%) serotyped *Salmonella* isolates, the seven most commonly identified serotypes were Enteritidis (1,081; 16%), Typhimurium (1,019; 15%), Newport (671; 10%), I 4,[5],12:i:- (360; 5%), Javiana (351; 5%), Heidelberg (249; 4%), and Montevideo (220; 3%). Of 104 (95%) *Vibrio* isolates speciated, the most commonly identified species were *V. parahaemolyticus* (61; 56%), *V. alginolyticus* (18; 16%), and *V. vulnificus* (13; 12%). Of the 2,714 (95%) *Shigella* isolates serotyped, the most commonly identified serotypes were *S. sonnei* (2,337; 81%) and *S. flexneri* (359; 13%). Of the 252 (93%) STEC non-O157 isolates for which an O antigen was determined, the most commonly identified O antigens were O103 (52; 21%), O26 (50; 20%), O121 (44; 17%), O111 (37; 15%), and O45 (12; 5%).

Table 4A. Number of laboratory-confirmed infections caused by specific bacterial pathogens reported, by site, FoodNet, 2007

Pathogen	CA	CO	CT	GA	MD	MN	NM	NY	OR	TN	Total
Campylobacter	923	421	493	688	414	907	350	522	705	448	5,871
Listeria	8	9	13	31	15	6	4	11	9	16	122
Salmonella	478	316	431	2047	870	711	283	521	320	851	6,828
Shigella	188	79	44	1638	109	237	107	38	66	363	2,869
STEC O157	39	32	45	47	22	166	10	58	73	54	546
STEC non-O157	9	55	26	42	35	41	23	12	5	24	272
STEC O Ag* Rough	0	0	1	0	0	1	1	0	0	3	6
STEC O Ag Undetermined	1	5	0	0	2	1	1	0	0	1	11
STEC O Ag not tested	0	0	0	2	0	0	0	0	0	0	2
Vibrio	13	4	16	23	26	8	0	9	8	3	110
Yersinia	15	4	18	44	8	24	3	16	19	13	164
Total	1,674	925	1,087	4,562	1,501	2,102	782	1,187	1,205	1,776	16,801

*Antigen.

Table 4B. Number of laboratory-confirmed infections caused by specific parasitic pathogens reported, by site, FoodNet, 2007

Pathogen	CA	CO	CT	GA	MD	MN	NM	NY	OR	TN	Total
Cryptosporidium	40	102	42	231	33	302	120	89	129	137	1,225
Cyclospora	1	0	3	3	1	0	2	2	0	1	13
Total	41	102	45	234	34	302	122	91	129	138	1,238

Seasonality

The number of infections reported varied by pathogen and month (Figures 2A, 2B, and 2C). In general, more infections with pathogens under FoodNet surveillance occur during the summer months. In 2007, 69% of *Cyclospora* infections occurred during June and July; 44% of *Campylobacter* infections occurred from June through August; 56% *Listeria* infections and 58% *Salmonella* infections occurred from June through October; 48% of *Vibrio* and 45% STEC non-O157 infections occurred from July through August; and 66% of *Cryptosporidium* and 64% of STEC O157 infections occurred from July through October.

Figure 2A. Cases of *Campylobacter*, *Cryptosporidium*, *Salmonella*, and *Shigella* infection, by month, FoodNet, 2007

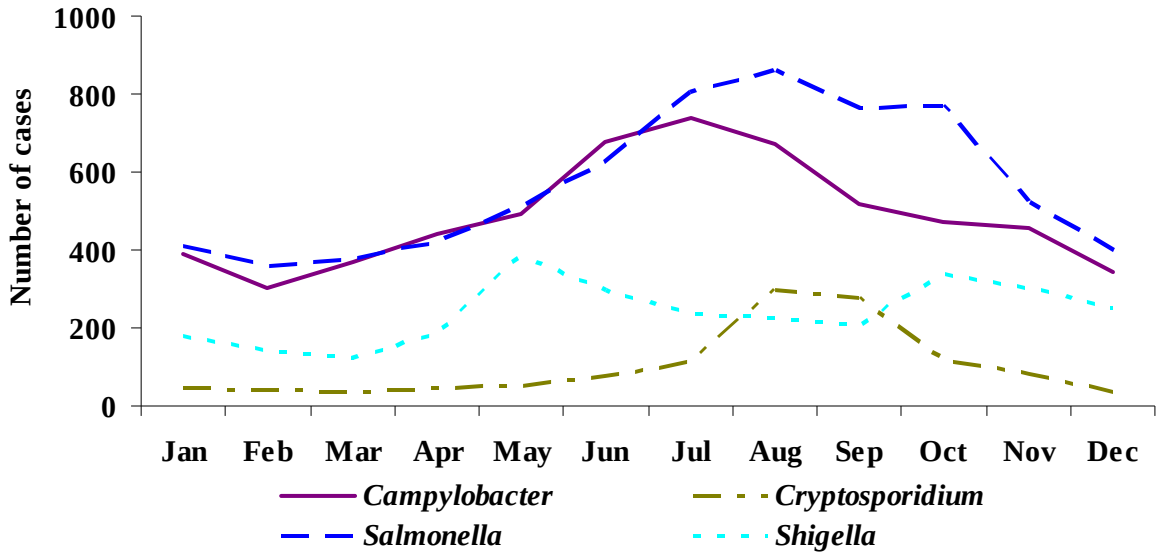


Figure 2B. Cases of STEC O157 and STEC non-O157 infection, by month, FoodNet, 2007

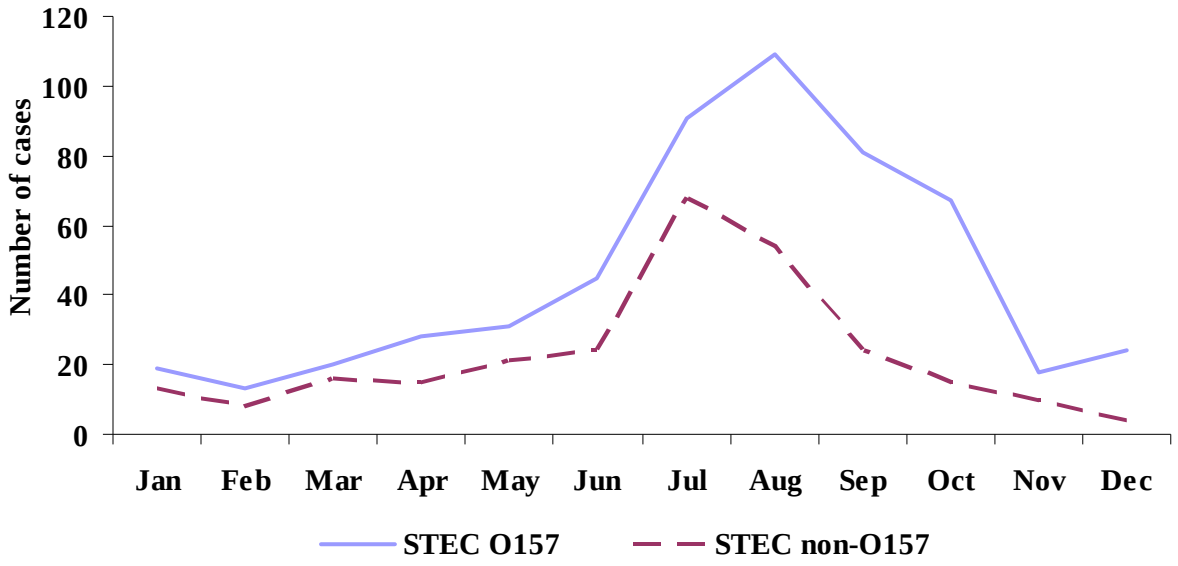
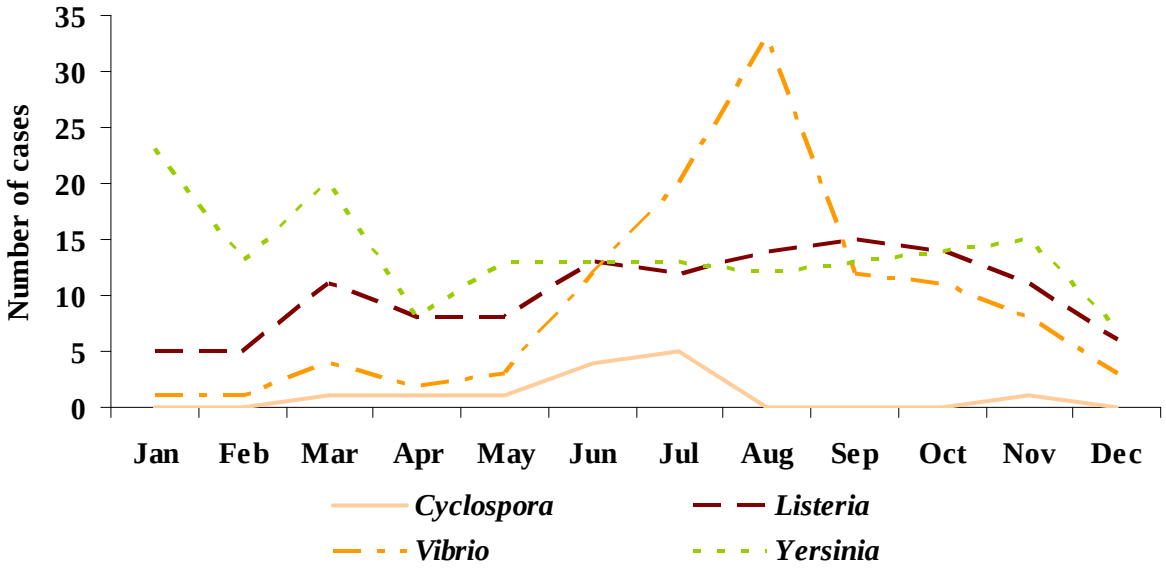


Figure 2C. Cases of *Cyclospora*, *Listeria*, *Vibrio*, and *Yersinia* infection, by month, FoodNet, 2007



Incidence

To compare the number of infections with pathogens under FoodNet surveillance across sites, incidence per 100,000 population was calculated. The incidence figures reported in Tables 5A and 5B and Figures 3A, 3B, and 3C were calculated using the 2007 census population counts. The incidence of infections in 2007 was highest for *Salmonella* (14.86/100,000 population), followed by *Campylobacter* (12.78), *Shigella* (6.24), *Cryptosporidium* (2.67), STEC O157 (1.19), STEC non-O157 (0.59), *Yersinia* (0.36), *Listeria* (0.27),*Vibrio* (0.24), *Cyclospora* (0.03), STEC O Antigen Undetermined (0.02), STEC O Antigen Rough (0.01), and STEC O Antigen not tested (0.004).

Table 5A. Incidence* of laboratory-confirmed infections caused by specific bacterial pathogens reported, by site, FoodNet, 2007

Pathogen	CA	CO	CT	GA	MD	MN	NM	NY	OR	TN	Overall
Campylobacter	28.41	15.58	14.08	7.21	7.37	17.45	17.77	12.23	18.81	7.28	12.78
Listeria	0.25	0.33	0.37	0.32	0.27	0.12	0.20	0.26	0.24	0.26	0.27
Salmonella	14.71	11.70	12.31	21.45	15.48	13.68	14.37	12.21	8.54	13.82	14.86
Shigella	5.79	2.92	1.26	17.16	1.94	4.56	5.43	0.89	1.76	5.90	6.24
STEC O157	1.20	1.18	1.28	0.49	0.39	3.19	0.51	1.36	1.95	0.88	1.19
STEC non-O157	0.28	2.04	0.74	0.44	0.62	0.79	1.17	0.28	0.13	0.39	0.59
STEC O Ag† Rough	0.00	0.00	0.03	0.00	0.00	0.02	0.05	0.00	0.00	0.05	0.01
STEC O Ag Undetermined	0.03	0.19	0.00	0.00	0.04	0.02	0.05	0.00	0.00	0.02	0.02
STEC O Ag not tested	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.004
Vibrio	0.40	0.15	0.46	0.24	0.46	0.15	0.00	0.21	0.21	0.05	0.24
Yersinia	0.46	0.15	0.51	0.46	0.14	0.46	0.15	0.37	0.51	0.21	0.36

*Cases per 100,000 population.

†Antigen.

Table 5B. Incidence* of laboratory-confirmed infections caused by specific parasitic pathogens reported, by site, FoodNet, 2007

Pathogen	CA	CO	CT	GA	MD	MN	NM	NY	OR	TN	Overall
Cryptosporidium	1.23	3.78	1.20	2.42	0.59	5.81	6.09	2.09	3.44	2.23	2.67
Cyclospora	0.03	0.00	0.09	0.03	0.02	0.00	0.10	0.05	0.00	0.02	0.03

*Cases per 100,000 population.

Figure 3A. Incidence of *Campylobacter*, *Cryptosporidium*, *Salmonella*, and *Shigella* infections per 100,000 population, by site, FoodNet, 2007

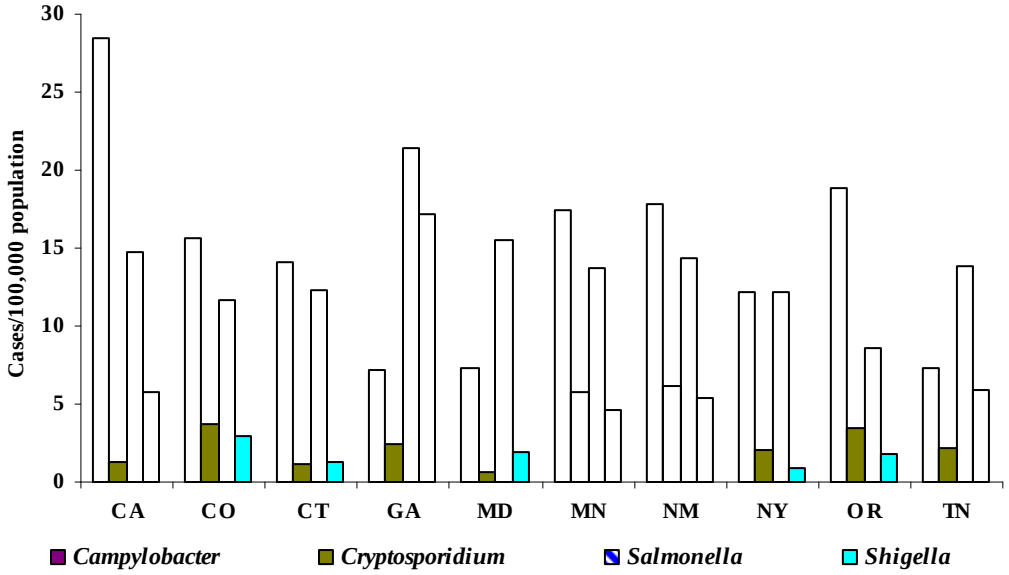


Figure 3B. Incidence of STEC O157 and STEC non-O157 infections per 100,000 population, by site, FoodNet, 2007

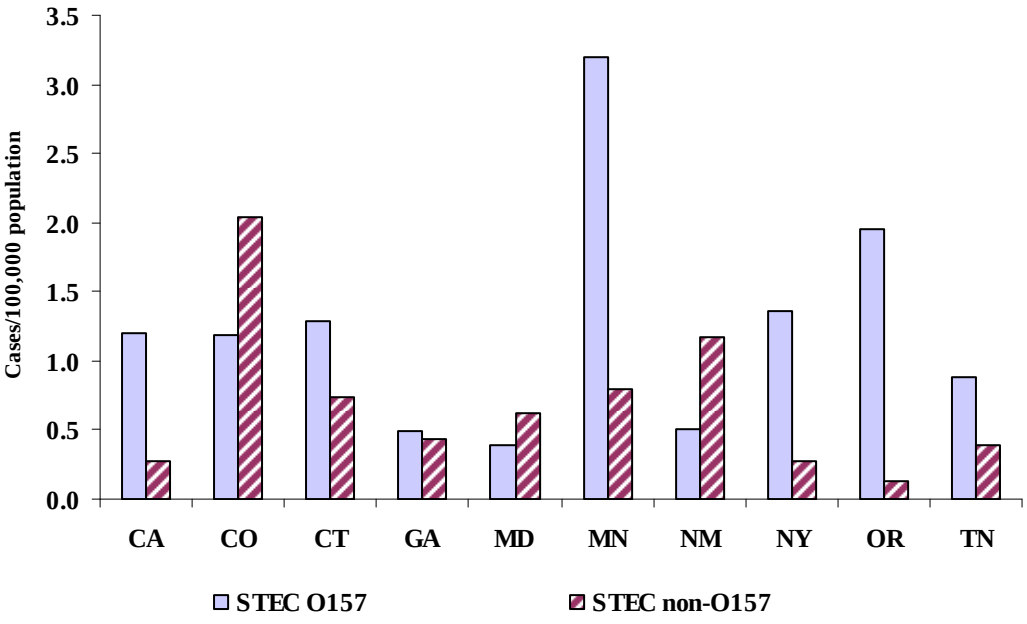
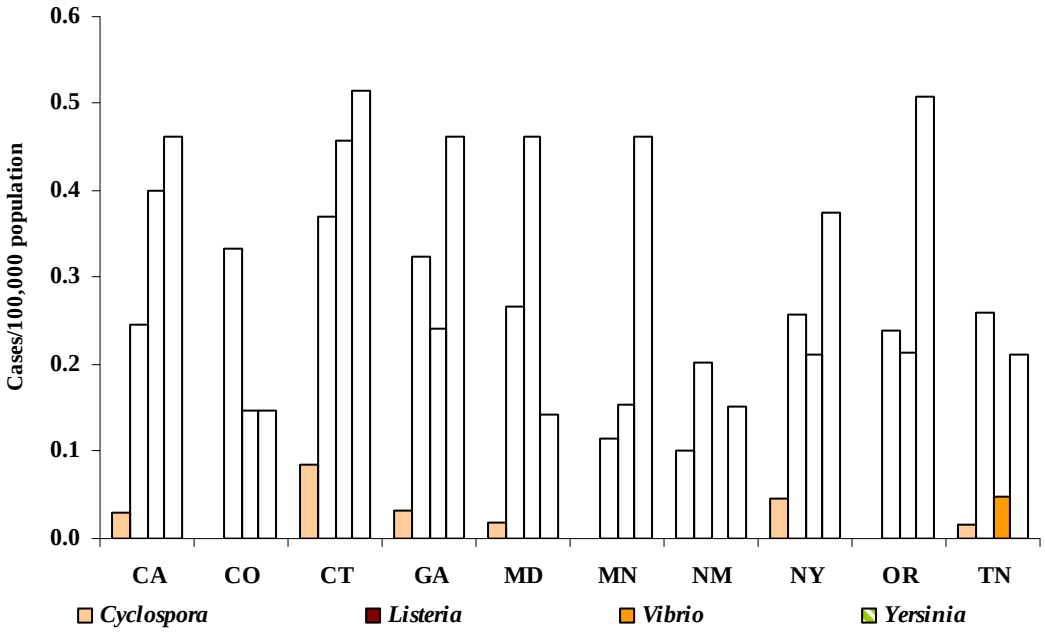


Figure 3C. Incidence of *Cyclospora*, *Listeria*, *Vibrio*, and *Yersinia* infections per 100,000 population, by site, FoodNet, 2007



Incidence by Age The incidence of infections caused by pathogens under FoodNet surveillance varied by age group (Figure 4A and 4B). The incidence of infections in children <1 year of age was substantially higher for *Salmonella*, *Campylobacter*, *Yersinia*, and *Listeria* compared to other age groups (118.26 per 100,000 population versus 13.39 per 100,000 population; 31.52 versus 12.51; 5.80 versus 0.28; and 2.51 versus 0.23, respectively). The incidences of *Shigella*, *Cryptosporidium*, and STEC O157 infections were highest among children 1-9 years of age (29.31 per 100,000 population versus 3.87 per 100,000 population; 6.17 versus 0.30; and 3.26 versus 1.12, respectively).

Figure 4A. Incidence of *Campylobacter*, *Salmonella*, and *Shigella* infections, by age group, FoodNet, 2007

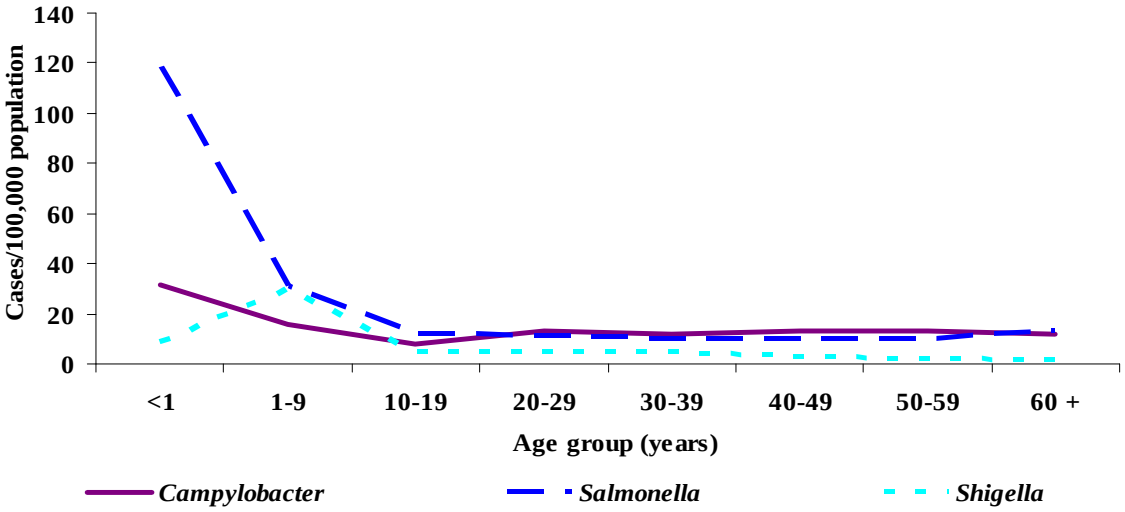
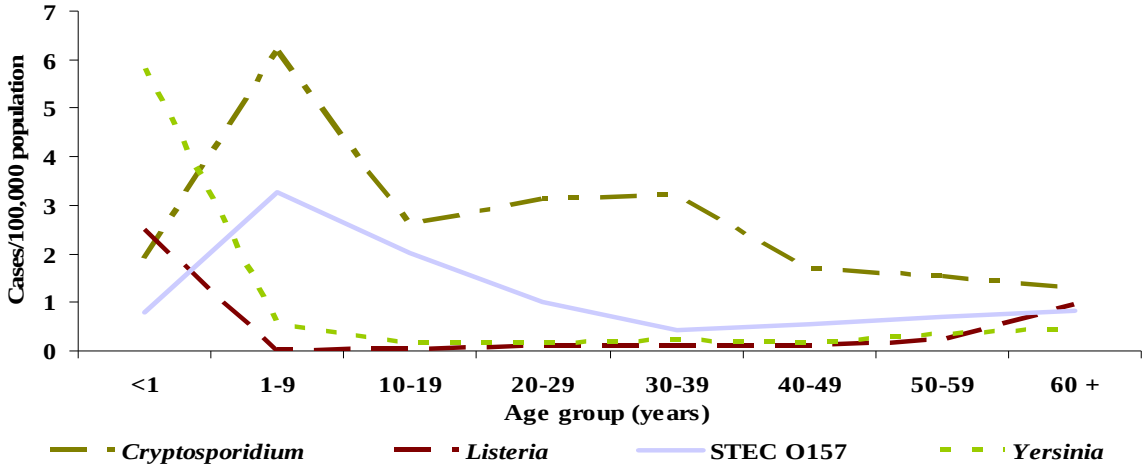


Figure 4B. Incidence of *Cryptosporidium*, STEC O157, and *Yersinia* infections, by age group, FoodNet, 2007



Incidence by Sex The incidence of *Vibrio*, *Campylobacter*, STEC non-O157, and *Yersinia* infections was higher among males; whereas the incidence of *Cyclospora*, *Listeria*, STEC O157, *Cryptosporidium*, *Shigella*, and *Salmonella* infections was somewhat higher among females (Table 6).

Table 6. Sex-specific incidence per 100,000 population, by pathogen, FoodNet, 2007

Pathogen	Male	Female
Campylobacter	14.49	11.09
Cryptosporidium	2.59	2.72
Cyclospora	0.02	0.03
Listeria	0.24	0.29
Salmonella	14.68	14.96
Shigella	6.10	6.37
STEC O157	1.12	1.26
STEC non-O157	0.65	0.53
Vibrio	0.35	0.13
Yersinia	0.38	0.33

Hospitalizations Hospitalization status was determined for 95% (17,124) of FoodNet cases (Table 7). Overall, 21% of persons with a laboratory-confirmed infection were hospitalized. The percentage of persons hospitalized was highest for *Listeria* (92% of reported cases), followed by STEC O157 (46%), *Vibrio* (31%), *Yersinia* (28%), *Salmonella* (26%), *Cryptosporidium* (18%), STEC O Antigen Rough (17%), *Shigella* (14%), *Campylobacter* (14%), STEC non-O157 (13%), STEC O Antigen Undetermined (9%). No hospitalizations were reported among *Cyclospora* cases.

Table 7. Frequency of hospitalization status, by pathogen, FoodNet, 2007

	Hospitalized		Outpatient		Total cases with hospitalization information		Unknown hospitalization status		Total cases reported
Pathogen	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**
Campylobacter	833	(14)	4,551	(78)	**5,384**	**(92)**	487	(8)	5,871
Cryptosporidium	226	(18)	947	(77)	**1,173**	**(96)**	52	(4)	1,225
Cyclospora	0	(-)	12	(92)	**12**	**(92)**	1	(8)	13
Listeria	112	(92)	8	(7)	**120**	**(98)**	2	(2)	122
Salmonella	1,786	(26)	4,773	(70)	**6,559**	**(96)**	269	(4)	6,828
Shigella	402	(14)	2,386	(83)	**2,788**	**(97)**	81	(3)	2,869
STEC O157	249	(46)	295	(54)	**544**	**(99)**	2	(0.3)	546
STEC non-O157	35	(13)	230	(85)	**265**	**(97)**	7	(3)	272
STEC O Ag* Rough	1	(17)	4	(67)	**5**	**(83)**	1	(17)	6
STEC O Ag Undetermined	1	(9)	9	(82)	**10**	**(91)**	1	(9)	11
STEC O Ag not tested	0	(-)	2	(100)	**2**	**(100)**	0	(-)	2
Vibrio	34	(31)	73	(66)	**107**	**(97)**	3	(3)	110
Yersinia	46	(28)	109	(66)	**155**	**(95)**	9	(5)	164
Total	3,725	(21)	13,399	(74)	**17,124**	**(95)**	915	(5)	18,039

*Antigen.

Deaths

In 2007, 64 persons with laboratory-confirmed infections were reported to have died. Of these, 26 were infected with *Salmonella*, 19 with *Listeria*, 7 with *Campylobacter*, 5 with *Cryptosporidium*, 4 with *Vibrio*, 2 with *Shigella*, and 1 with STEC O157. No deaths were reported for *Cyclospora*, STEC non-O157, STEC O Antigen Rough, STEC O Antigen Undetermined, or *Yersinia*. *Listeria* had the highest case-fatality rate (16%; Table 8).

Table 8. Frequency of patient outcome, by pathogen, FoodNet, 2007

Pathogen	Alive	Dead	Total cases with outcome information		Unknown		Total cases reported	Case fatality rate (CFR)*
	No.	No.	No.	(%)	No.	(%)	No.	
Campylobacter	4,920	7	**4,927**	**(84)**	944	(16)	5,871	**0.12**
Cryptosporidium	1,154	5	**1,159**	**(95)**	66	(5)	1,225	**0.41**
Cyclospora	12	0	**12**	**(92)**	1	(8)	13	-
Listeria	102	19	**121**	**(99)**	1	(1)	122	**15.57**
Salmonella	6,319	26	**6,345**	**(93)**	483	(7)	6,828	**0.38**
Shigella	2,460	2	**2,462**	**(86)**	407	(14)	2,869	**0.07**
STEC O157	541	1	**542**	**(99)**	4	(1)	546	**0.18**
STEC non-O157	265	0	**265**	**(97)**	7	(3)	272	-
STEC O Ag† Rough	6	0	**6**	**(100)**	0	-	6	-
STEC O Ag Undetermined	10	0	**10**	**(91)**	1	(9)	11	-
STEC O Ag not tested	2	0	**2**	**(100)**	0	()	2	-
Vibrio	100	4	**104**	**(95)**	6	(5)	110	**3.64**
Yersinia	146	0	**146**	**(89)**	18	(11)	164	-
Total	16,037	64	**16,101**	**(89)**	1,938	(11)	18,039	**0.35**

*CFR = (number of patients reported to have died/total number cases) x 100.
†Antigen.

International Travel

Of the 514 (94%) STEC O157 cases for whom travel information was available, 3% reported international travel, and, of 5,177 (76%) *Salmonella* infection for whom travel information was available, 11% reported international travel (Table 9).

Table 9. Frequency of international travel among persons with *Salmonella* and STEC O157 infections, by pathogen, FoodNet, 2007

Pathogen	Yes		No		Total cases with travel information		Unknown		Total cases reported
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.
Salmonella	584	(11)	4,593	(89)	**5,177**	**(76)**	1,651	(24)	6,828
STEC O157	16	(3)	498	(97)	**514**	**(94)**	32	(6)	546

Outbreak-related Cases

Five percent of the cases reported to FoodNet were known to be outbreak-related; 54% of these outbreaks were foodborne (Table 10). The most common outbreak-related etiologies were *Salmonella*, *Shigella*, and STEC O157, which accounted for 90% of all outbreak-related cases. Of the 6,828 *Salmonella* cases ascertained, 416 (6%) were identified as being outbreak-related. Of these, 86% were foodborne, 11% were nonfoodborne, and for 3% the mode of transmission was unknown. Of the 2,869 *Shigella* cases ascertained, 283 (10%) were identified as being outbreak-related; none of these outbreaks was determined to be foodborne. Of the 546 STEC O157 cases ascertained, 97 (18%) were identified as being outbreak-related. Of these, 72% were foodborne and 28% were nonfoodborne.

Table 10. Frequency of outbreak-related cases, by pathogen, FoodNet, 2007

Pathogen	Outbreak-related cases		Foodborne related		Nonfoodborne related		Unknown	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Campylobacter	7	(0.1)	4	(57)	0	(-)	3	(43)
Cryptosporidium	32	(3)	2	(6)	30	(94)	0	(-)
Salmonella	416	(6)	357	(86)	47	(11)	12	(3)
Shigella	283	(10)	0	(-)	283	(100)	0	(-)
STEC O157	97	(18)	70	(72)	27	(28)	0	(-)
STEC non-O157	45	(17)	43	(96)	2	(4)	0	(-)
STEC O Ag* Undetermined	1	(9)	0	(-)	1	(100)	0	(-)
Vibrio	1	(1)	1	(100)	0	(-)	0	(-)
Total	882	(5)	477	(54)	390	(44)	15	(3)

*Antigen.

Progress Towards National Health Objectives

Healthy People 2010 national health objectives exist for four of the FoodNet pathogens under surveillance; *Campylobacter*, *Listeria*, *Salmonella*, and STEC O157. Although the incidence of infections with *Campylobacter*, *Listeria* and STEC O157 are close to meeting their respective objectives the incidence of *Salmonella* infections substantially exceeds its objective (Table 11).

Table 11. Comparison of 2007 incidence* with the Healthy People 2010 Objectives

Pathogen	2007 Crude Rate	National health objective
Campylobacter	12.78	12.30[†]
Listeria	0.27	0.25[‡]
Salmonella	14.86	6.80[†]
STEC O157	1.19	1.00[†]

*Cases per 100,000 population.

[†]2010 Healthy People objective.

[‡]2005 objective.

Modeled 2007 Incidence

The incidence of several infections in 2007 differed significantly when compared with 1996-1998 period**.** The incidence of infections caused by *Campylobacter*, *Listeria*, *Salmonella*, *Shigella*, STEC O157, and *Yersinia* was significantly lower (Table 12 and Figures 5A, 5B, 5C).

The estimated incidence of *Yersinia* was 49% lower (95% CI=-59% to -35%), *Listeria* was 43% lower (95% CI=-55% to -28%), *Shigella* was 37% lower (95% CI=-56% to -10%), *Campylobacter* was 31% lower (95% CI=-36% to -24%), STEC O157 was 26% lower (95% CI=-39% to -10%), and *Salmonella* was 8% lower (95% CI=-15% to -2%). The estimated incidence of *Cryptosporidium* and *Vibrio* was not significantly different from the 1996-1998 comparison period.

Compared with the previous 3 years (2004-2006), however, the estimated 2007 incidence of infections caused by *Campylobacter*, *Listeria*, *Salmonella*, *Shigella*, STEC O157, *Vibrio*, and *Yersinia* did not change significantly from the comparison period (Figure 6). The estimated 2007 incidence of *Cryptosporidium* infections was 44% higher (95% CI=8% to 90%) compared with the 2004-2006 time period.

Of the most common *Salmonella* serotypes reported in 2007, only serotype Typhimurium declined (52% lower; 95% CI=-58% to -46%) compared with the 1996-1998 period (Table 13 and Figure 7). Significantly higher estimated incidences were seen for serotype Newport (71% higher; 95% CI=31% to 123%), Javiana (59% higher; 95% CI=2% to 149%), and Enteritidis (24% higher; 95% CI=1% to 52%). For serotypes Heidelberg or Montevideo, the estimated incidence in 2007 was similar to that of the 1996-1998 comparison period.

Compared with 2004-2006, there were only significant declines in the estimated 2007 incidence of *Salmonella* serotypes Typhimurium (19% lower; 95% CI=-27% to -10%) and Heidelberg (18% lower; 95% CI=-32% to -1%) (Figure 8). Significant higher estimated incidences were seen for serotypes I 4,[5],12:i:- (75% higher; 95% CI=24% to 147%) and Newport (28% higher; 95% CI=5% to 55%).

Table 12. Percent change in incidence* of laboratory-confirmed infections with pathogens under surveillance in FoodNet, by pathogen, 2007 compared with 1996-1998

Pathogen	Change	95% confidence interval
Bacterial		
Campylobacter	-31%	-36% to -25%
Listeria	-43%	-55% to -28%
Salmonella	-8%	-15% to -2%
Shigella	-37%	-56% to -10%
STEC O157	-26%	-39% to -0%
Vibrio	29%	-6% to 78%
Yersinia	-49%	-59% to -36%
Parasitic		
Cryptosporidium†	31%	-14% to 100%

*Cases per 100,000 population.
†2007 compared with 1997-1998.

Figure 5A. Relative rates of laboratory-confirmed infections with *Campylobacter*, *Listeria*, *Salmonella*, and STEC O157, *Vibrio* compared with 1996-1998 rates, by year, FoodNet, 1996-2007

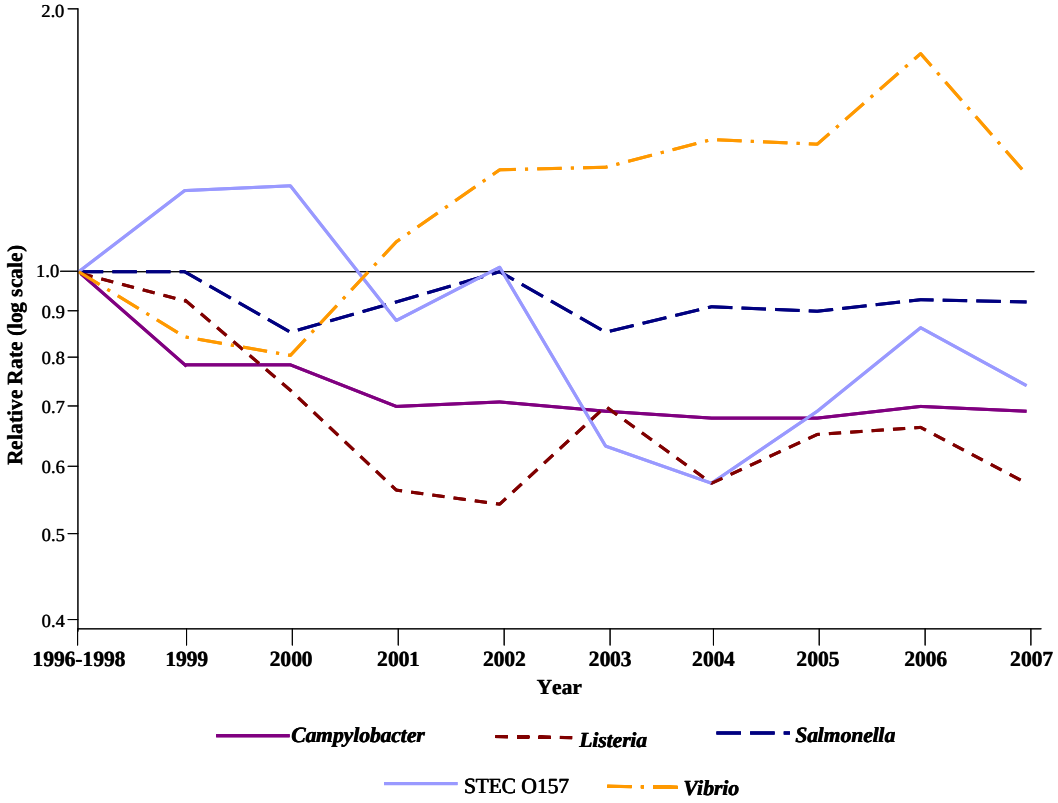


Figure 5B. Relative rates laboratory-confirmed infections with *Shigella*, and *Yersinia* compared with 1996-1998 rates, by year, FoodNet, 1996-2007

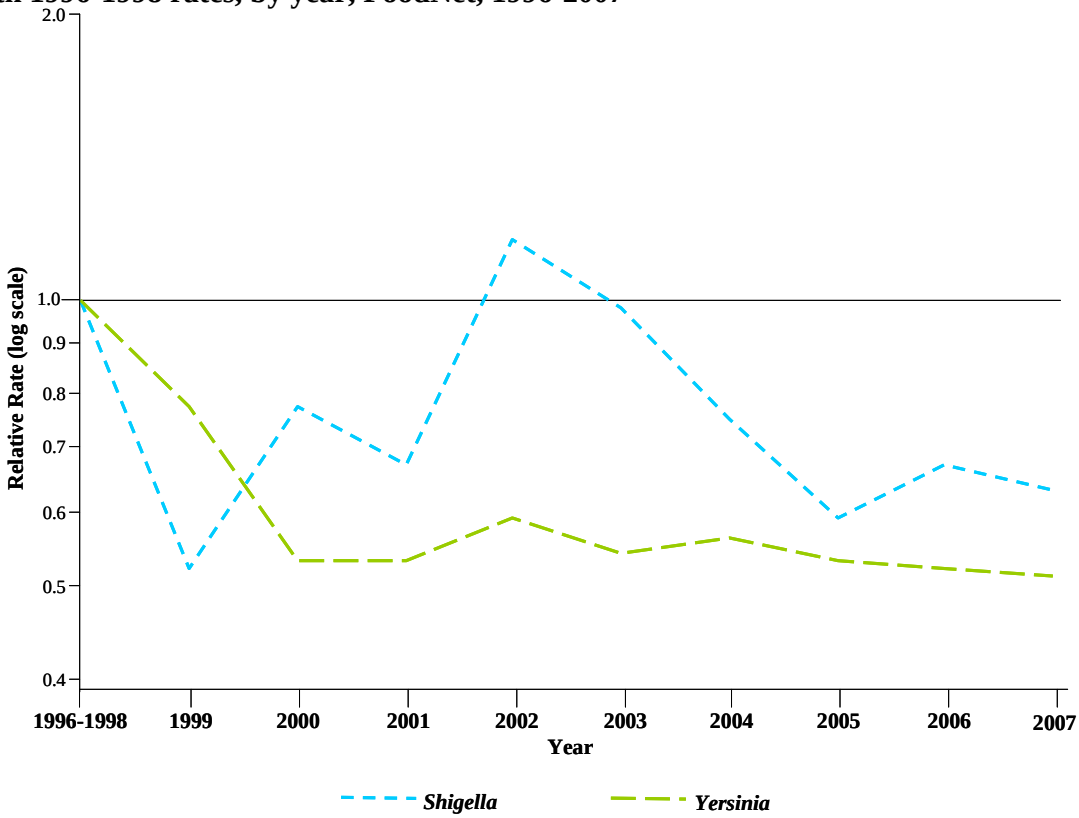


Figure 5C. Relative rates of laboratory-confirmed infections with *Cryptosporidium* compared with 1996-1998 rates, by year, FoodNet, 1997-2007

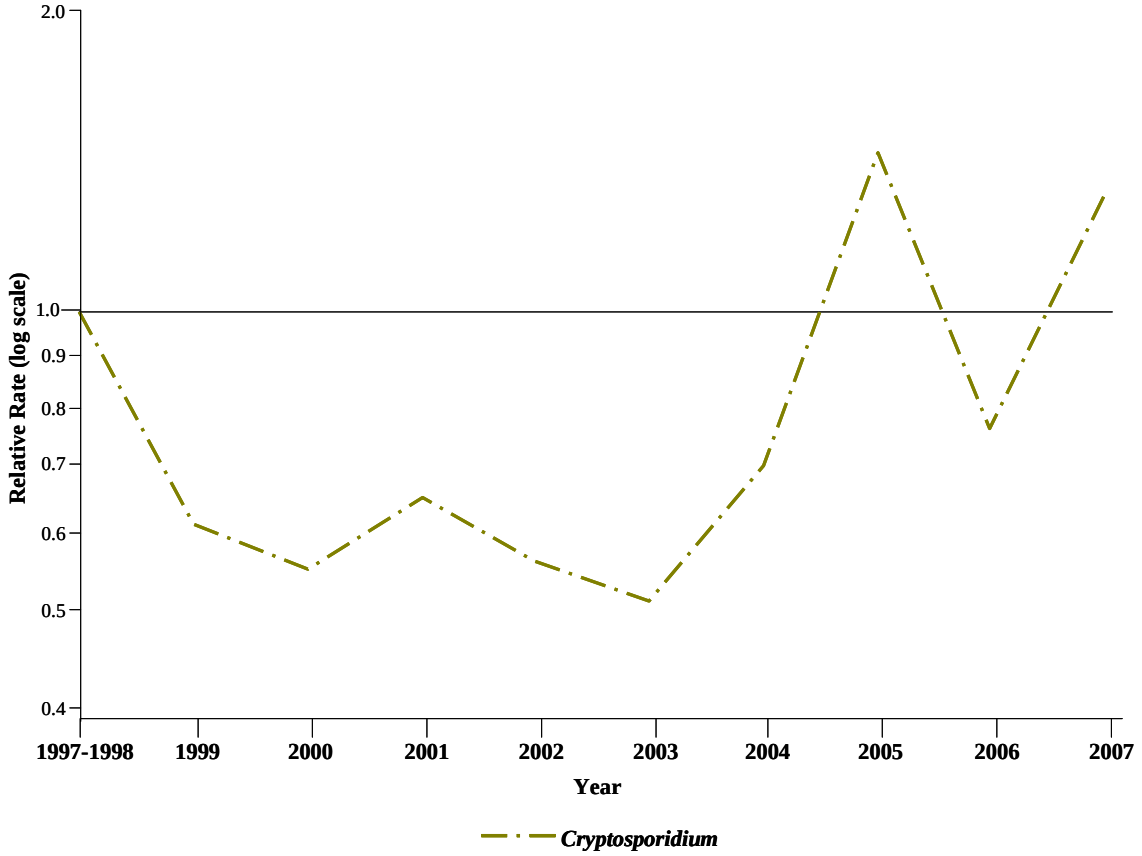
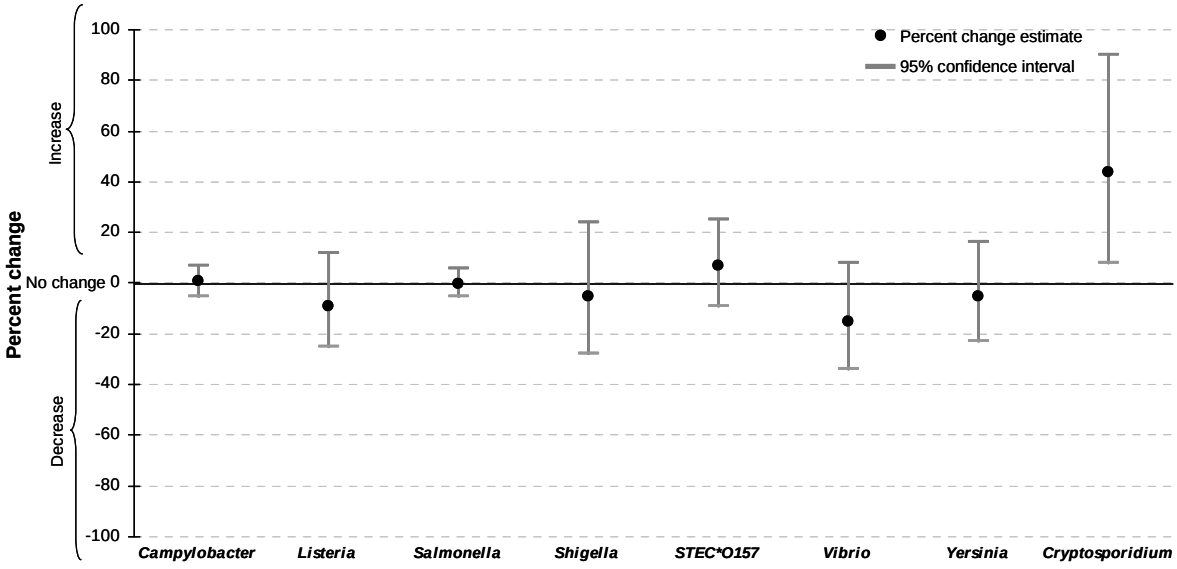


Figure 6. Percent change in incidence of laboratory-confirmed bacterial and parasitic infections in 2007 compared with average annual incidence during 2004-2006, by pathogen, FoodNet



* Shiga toxin-producing *Escherichia coli*.

How to interpret the graph

Significant decrease = The estimate and 95% confidence intervals are both BELOW the no change line

Significant increase = The estimate and 95% confidence intervals are both ABOVE the no change line

No change = No significant increase or no significant decrease observed

Table 13. Percent change in incidence* of laboratory-confirmed infections with selected *Salmonella* serotypes under surveillance in FoodNet, by serotype, 2007 compared with 1996-1998

Serotype	Change	95% confidence interval
Enteritidis	24%	1% to 52%
Heidelberg	-19%	-35% to 2%
Javiana	59%	2% to 149%
Montevideo	-5%	-33% to 36%
Newport	71%	31% to 123%
Typhimurium	-52%	-58% to -46%

*Cases per 100,000 population.

Figure 7. Relative rates of laboratory-confirmed infections with selected *Salmonella* serotypes compared with 1997-1998 rates, by year, FoodNet, 1996-2007

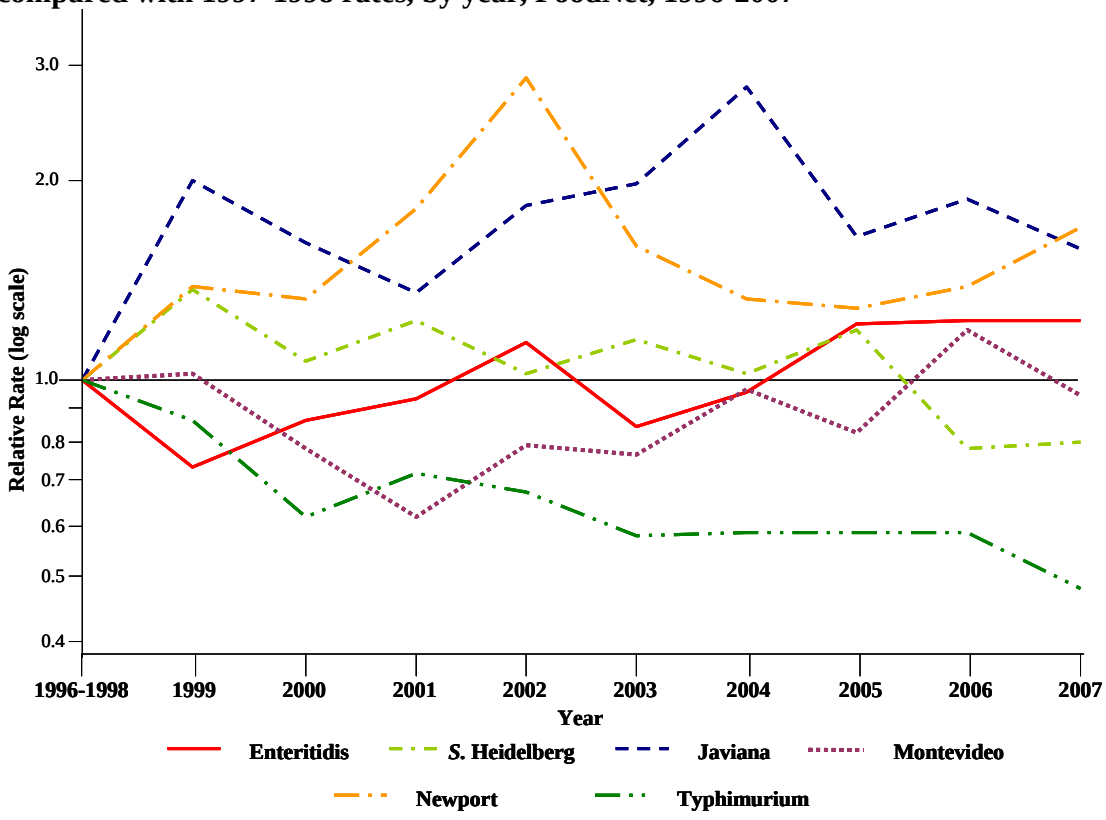
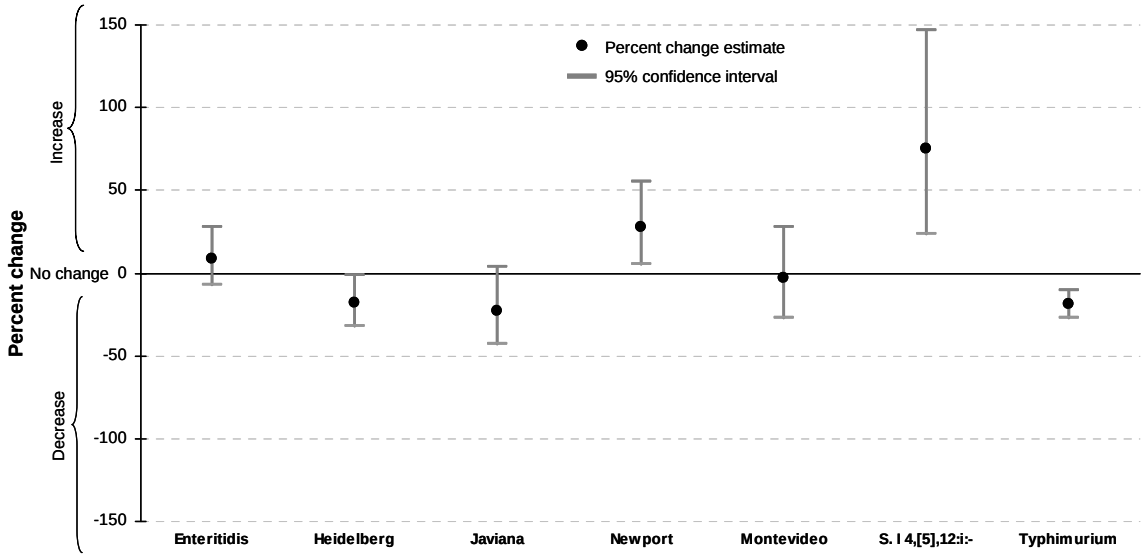


Figure 8. Percent change in incidence of laboratory-confirmed selected *Salmonella* serotype infections in 2007 compared with average annual incidence during 2004-2006, by serotype, FoodNet



How to interpret the graph

Significant decrease = The estimate and 95% confidence intervals are both BELOW the no change line

Significant increase = The estimate and 95% confidence intervals are both ABOVE the no change line

No change = No significant increase or no significant decrease observed

Hemolytic Uremic Syndrome Surveillance

Hemolytic uremic syndrome (HUS) is a life-threatening illness characterized by microangiopathic hemolytic anemia, thrombocytopenia, and acute renal failure. Most cases of HUS in the United States are preceded by diarrhea due to infection with STEC. STEC O157 is the most frequently isolated STEC serotype among HUS cases, but other serotypes can also cause HUS.

Data from HUS surveillance are reported one year later than data from FoodNet Active Surveillance because of the time required for review of medical records and hospital discharge data for HUS cases.

Cases Reported, 2006

In 2006, FoodNet ascertained 118 HUS cases, including 109 (92%) post-diarrheal cases. Among post-diarrheal HUS cases, 3 (3%) persons died. Ninety-three (85%) pediatric (in persons less than 18 years of age) post-diarrheal HUS cases were reported; among these 65 (60%) cases were in children less than five years of age. Sixty-eight percent of HUS cases were diagnosed during June through September.

Results, 1997-2006

A total of 771 HUS cases were reported from 1997 through 2006, 681 (88%) of these cases were post-diarrheal (Table 14). Most post-diarrheal HUS cases occurred in females (58%), and the median age of patients was four years. Ninety-six percent of the cases were hospitalized, with a median length of hospitalization of 12 days.

Stool specimens were obtained from 649 (95%) post-diarrheal HUS cases; 614 (95%) were cultured for STEC O157, and STEC O157 was isolated from 354 (58%) stools. Only 278 (43%) stool specimens were tested for Shiga toxin and, of these, 189 (68%) tested positive for the presence of Shiga toxin. Stool specimens from 34 (5%) post-diarrheal HUS cases were reported to have been cultured for non-O157 STEC. Non-O157 STEC was isolated from nine (26%) stools and one urine sample; two infections were caused by O111, three were caused by O145, and one was caused by O121. Three additional cases were reported in which a non-O157 STEC was identified but the O antigen was not determined (Table 15). Serum samples from 53 post-diarrheal cases were tested for antibodies to O157, O111 or O26 lipopolysaccharide (LPS). Thirty-eight (72%) cases had antibodies to O157 LPS, one case had antibodies to O111LPS, and no cases had antibodies to O26 LPS.

Table 14. Summary of post-diarrheal HUS cases, FoodNet, 1997-2006

Number of post-diarrheal HUS cases	681
Median Age (age range)	4.5 (0-89)
Percent female	58%
Median Hospitalization (days)	12 days
Deaths (%)	41 (6)

Table 15. Results of microbiologic testing for STEC infection among post-diarrheal HUS cases, FoodNet, 1997-2006

Diarrhea in three weeks before HUS diagnosis / Total patients	681/771	88%
Stool specimen obtained / Total patients	649/681	95%
Stool cultured for *E. coli* O157 / Patients with stool specimen obtained	614/649	95%
E. coli O157 isolated from stool / Patients with stool cultured for *E. coli* O157	354/614	58%
Stool tested for Shiga toxin / Patients with stool specimen obtained	278/649	43%
Stool Shiga toxin-positive / Patients with stool tested for Shiga toxin	189/278	67%
Non-O157 STEC tested from stool / Patients tested for Shiga toxin	34/189	18%
Non-O157 STEC isolated from stool / Non-O157 STEC tested from stool	9/34	26%
Stool yielding *E. coli* O157, non-O157 STEC and/or Shiga toxin + / Total patients with stool cultured for *E. coli*	372/614	61%

Pediatric HUS, 1997-2006

FoodNet identified 550 (81%) post-diarrheal HUS cases in children less than 18 years of age. The overall incidence rate was 0.65 per 100,000 population and was highest in children under five years of age (1.60 per 100,000 population) (Table 16).

Hospital discharge data review was used to validate pediatric HUS diagnoses and to identify additional HUS cases. Between 2000 and 2006, 39% of the post-diarrheal pediatric HUS cases reported to FoodNet were identified through active surveillance alone, 12% were identified through hospital discharge data review alone, and 45% were identified by both active surveillance and hospital discharge data review (Table 17).

HUS surveillance can be used to corroborate incidence patterns of STEC O157 seen in FoodNet. A comparison of the crude incidence of pediatric STEC O157 and pediatric HUS cases is seen in Figure 9. Overall, the crude incidence rates of pediatric STEC O157 infection and HUS demonstrate a general correlation in trends.

Table 16. Number and incidence rate* of pediatric post-diarrheal HUS cases, by site and age group, FoodNet, 1997-2006

	Age <5 years		Age 5-14 years		Age 15-17 years		Total	
State	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
CA	26	1.42	16	0.44	0	0.00	42	0.65
CO†	21	1.88	8	0.39	1	0.16	30	0.79
CT	25	1.19	20	0.43	2	0.15	47	0.58
GA	47	0.82	14	0.13	3	0.09	64	0.32
MD†	22	0.90	13	0.25	0	0.00	35	0.38
MN	80	2.41	42	0.59	1	0.04	123	0.97
NM†	4	0.95	1	0.12	0	0.00	5	0.33
NY†	27	1.69	12	0.32	3	0.25	42	0.65
OR	64	2.86	17	0.36	3	0.20	84	1.00
TN†	54	2.50	23	0.53	1	0.08	78	0.99
Total	370	1.60	166	0.35	14	0.10	550	0.65

*Cases per 100,000 population.

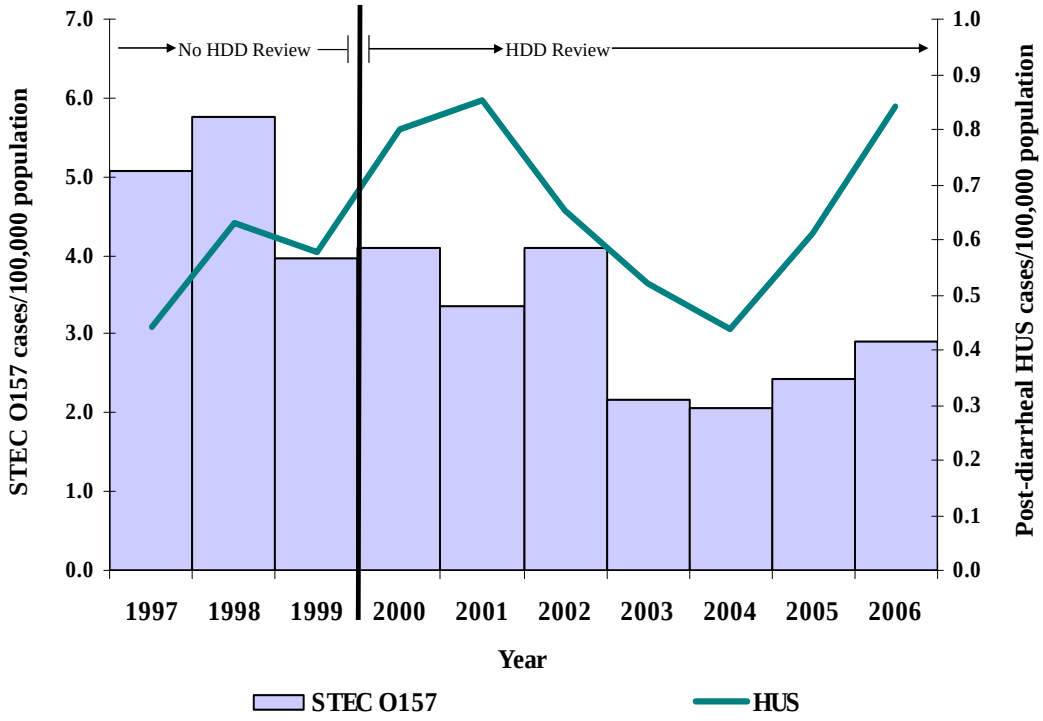
†HUS surveillance started in CO in 2001, MD in 1999, NM in 2004, and TN in 2000.

Table 17. Method of identification of post-diarrheal pediatric HUS cases, by year, FoodNet, 2000-2006

	2000		2001		2002		2003		2004*		2005*		2006*		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Active Surveillance Only	26	42	42	56	30	48	18	33	16	33	19	29	28	32	179	39
Hospital Discharge Data Only (HDD)	10	16	8	11	6	10	7	13	3	6	10	15	9	10	53	12
Active and HDD	15	24	24	32	26	42	26	48	29	60	37	56	47	53	204	45
Unknown	11	18	1	1	0	0	3	6	0	0	0	0	5	6	20	4
Total cases	62		75		62		54		48		66		89		456	

*NM is excluded because they do not conduct hospital discharge data review.

Figure 9. Comparison of pediatric incidence rates of STEC O157 and HUS, FoodNet, 1997-2006



Discussion

Declines in incidence of Foodborne pathogens

Although significant declines in the incidence of certain foodborne pathogens have occurred since 1996, these declines all occurred before 2004. Comparing 2007 with 2004-2006, the estimated incidence of infections caused by *Campylobacter, Listeria, Salmonella, Shigella,* STEC O157*, Vibrio,* and *Yersinia* did not decline significantly, and the incidence of *Cryptosporidium* infections increased. The incidence of *Salmonella* infections in 2007 was the furthest from the national target for 2010.

Salmonella

Transmission of *Salmonella* to humans can occur by many routes, including consumption of food animal products, raw produce contaminated with animal waste, contact with animals and their environment, and contaminated water. Outbreaks caused by contaminated peanut butter, frozen pot pies, and a puffed vegetable snack that occurred in 2007 underscore the need to prevent contamination of commercially produced foods. An outbreak associated with turtle exposure highlights the importance of animals as a nonfood source of human infections. To reduce the incidence of *Salmonella* infections, concerted efforts are needed throughout the food supply chain, from farm to processing plant to kitchen. Recognizing the need to prevent *Salmonella* contamination of poultry products and other meats, the U.S. Department of Agriculture's Food Safety and Inspection Service (USDA FSIS) launched a *Salmonella* initiative in 2006, with enhancements in 2008 (*2*). A USDA FSIS testing program reported recent declines in the percentage of broiler chicken carcasses that yielded *Salmonella,* from 16.3% in 2005 to 11.4% in 2006 and 8.5% in 2007 (*3*).

STEC

Declines in the incidence of STEC O157 infections in 2003 and 2004 have not been maintained. Although the USDA FSIS and the beef processing industry have implemented interventions to reduce ground beef contamination, 21 beef product recalls due to possible contamination with STEC O157 were issued in 2007. Beef from 10 of these was highly associated with illness. This represents an increase compared with previous years. USDA FSIS launched an STEC O157 initiative in fall 2007 and hosted a public meeting in spring 2008 to explore solutions to the challenges this pathogen presents. Additional efforts are needed to control STEC O157 in cattle and to prevent its spread to other food animals and food products, such as produce.

2 CDC. Multistate outbreak of human *Salmonella* infections associated with exposure to turtles---United States, 2007--2008. MMWR 2008; 57:69--72.

3 CDC. Multistate outbreak of *Salmonella* serotype Tennessee infections associated with peanut butter---United States, 2006--2007. MMWR 2007;57:521--4.

Cryptosporidium

The increase in reported *Cryptosporidium* infections compared with 2004-2006 might reflect, at least in part, an increase in diagnostic testing stimulated by licensing of a new treatment (nitazoxanide). The incidence of *Campylobacter, Salmonella, Shigella,* and STEC O157 infections remains highest among children aged <5 years, highlighting the need for targeted interventions. Identified risk factors for bacterial enteric illness in young children include riding in a shopping cart next to raw meat or poultry, attendance at day care, visiting or living on a farm, and living in a home with a reptile (*4,5*). Recent *Salmonella* outbreaks associated with exposure to small turtles (carapace lengths of <4 inches) highlight the importance of enforcing a 1975 prohibition on the sale and distribution of such turtles in the United States (*3*).

National Health Objectives

Much remains to be done to reach the national health objectives for foodborne illnesses. Enhanced measures are needed to understand the complex ecologies that link pathogens to animals and plants; to control or eliminate pathogens in food sources; to reduce or prevent contamination during food growing, harvesting, and processing; and to educate restaurant workers and consumers about infection risks and prevention measures. Such measures can be more focused when the sources of human infections are known. More outbreaks can be recognized through more rapid and complete subtyping of pathogens and interviewing of ill persons and controls when clusters of illness are recognized.

How consumers can reduce risk

Consumers can reduce their risk for foodborne illness by following safe food-handling recommendations and by avoiding consumption of unpasteurized milk, raw or undercooked oysters, raw or undercooked eggs, raw or undercooked ground beef, and undercooked poultry. The risk for foodborne illness also can be decreased by choosing in-shell pasteurized eggs, irradiated ground meat, and high-pressure-treated oysters.

4 Fullerton KE, Ingram LA, Jones TF, et al. Sporadic *Campylobacter* infection in infants a population-based surveillance case-control study. *Pediatr Infec Dis J* 2007;26:19--24.

5 Jones TF, Ingram LA, Fullerton KE, et al. A case-control study of the epidemiology of sporadic *Salmonella* infection in infants. *Pediatrics* 2006;118:2380--7.

Limitations

The findings in this report are subject to at least four limitations. First, FoodNet case definitions rely on laboratory diagnoses. However, many foodborne illnesses are unreported, either because ill persons do not seek medical care, or because stool cultures or other diagnostic tests are not ordered. Second, protocols for isolation of certain enteric pathogens (e.g., STEC non-O157) in clinical laboratories vary and are not uniform either within or among FoodNet sites (*6*). Both of these situations lead to an under-estimation of the true number of cases. Third, reported illnesses might have been acquired through nonfoodborne transmission: reported incidence rates do not reflect foodborne transmission exclusively. Finally, results may not be generalizable to the entire population. However, the Foodnet surveillance population is demographically similar to the United States population, except for an under-representation of Hispanics.

6 Voetsch AC, Angulo FJ, Rabatsky-Ehr T, et al. Laboratory practices for stool-specimen culture for bacterial pathogens, including *Escherichia coli* O157:H7, in the FoodNet sites, 1995–2000. *Clin Infect Dis*. 2004;38(suppl 3):S190–7.

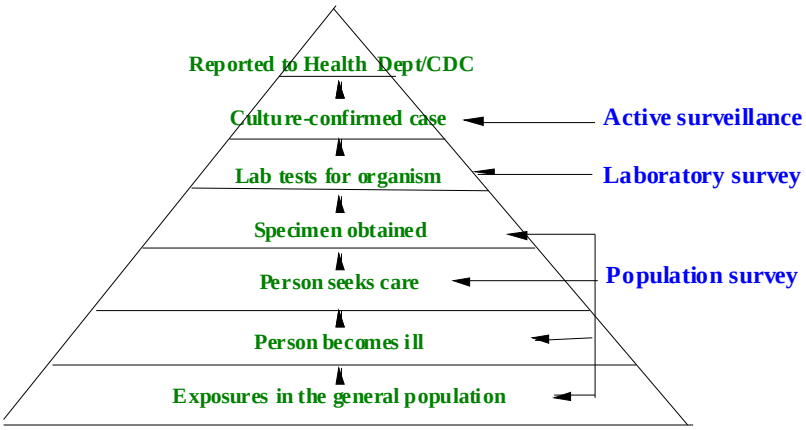
Other FoodNet Data Sources

Burden of Illness

Cases reported through active surveillance are only a fraction of the true number of cases occurring in the community. To better estimate the number of cases of foodborne disease in the community, FoodNet conducts surveys of laboratories and the general population in the FoodNet sites (Figure 10). Using these data, we can determine the proportion of persons in the general population who experience a diarrheal illness over a given period of time, and, among those, the number who seek medical care for the illness and who submit a specimen for laboratory testing. We can evaluate how variations in laboratory testing for bacterial pathogens influence the number of laboratory-confirmed cases. Using FoodNet and other data, CDC estimated, in 1999, that 76 million foodborne illnesses, 325,000 hospitalizations, and 5,000 deaths occurred in the United States (*7*).

This model can be used to estimate the burden of illness caused by each foodborne pathogen. For example, data from this model suggest that during 1996-1999 there were 1.4 million nontyphoidal *Salmonella* infections per year, resulting in 113,000 physician office visits and 36,242 culture-confirmed cases in this country. Laboratory-confirmed cases alone resulted in an estimated 8,500 hospitalizations and 300 deaths; additional hospitalizations and deaths occur among persons whose illness is not laboratory diagnosed (*8*).

Figure 10. Burden of illness pyramid



7 Mead P, Slutsker L, Dietz V, et al. Food-related illness and death in the United States. *Emerg Infect Dis*. 1999;5:607–25.
8 Voetsch A, Van Gilder T, Angulo F, et al. FoodNet estimate of burden of illness caused by nontyphoidal *Salmonella* infection in the United States. *Clin Infect Dis.* 2004;38(3):S127–134.

Routes of Transmission of Foodborne Pathogens

FoodNet conducts case-control studies to determine the proportion of foodborne diseases that are caused by consumption of specific foods or are related to specific food preparation and handling practices. To date, FoodNet has conducted case-control studies of STEC O157; *Salmonella* serotypes Enteritidis, Heidelberg, Newport, and Typhimurium; *Campylobacter*; *Cryptosporidium*; and *Listeria* infection as well as infant *Salmonella* and *Campylobacter* infections. By determining the contribution to these foodborne diseases made by specific foods or food preparation and handling practices, prevention efforts can be targeted to groups appropriately.

Other FoodNet Activities in 2007

- Published 14 peer reviewed publications
- Presented 35 abstracts at scientific meetings
- Continued to conduct and improve the quality of surveillance data
  - Updated FoodNet surveillance protocol
  - Updated FoodNet performance standards
  - Revised FoodNet variable list
  - Reviewed quality of new STEC variables capturing Shiga toxin information
  - Evaluated ascertainment of STEC cases in light of changing laboratory practices
- Completed business rules and requirements for development of new FoodNet application (FoodNet 2.0)
- Continued integration of FoodNet surveillance data with other Enteric Diseases Epidemiology Branch data sources.
  - Completed pilot project linking data from PulseNet and NARMS
- Continued efforts to improve reporting of outbreaks in FoodNet sites to eFORS
  - Presented preliminary analysis of contributing factor supplemental data
  - Presented preliminary analysis of ill food-worked supplemental data
- Continued to improve analysis of trends in FoodNet surveillance
  - Initiated use of new previous 3 year's comparison period.
  - Evaluated the exclusion of outbreak-related cases and international travel-related cases on FoodNet pathogen incidence rates for 2004 to the present.
- Presented preliminary analysis results from 1st FoodNet community-acquired *C. difficile* surveillance pilot data.
- Completed data collection for the 2006-2007 FoodNet Population Survey.
- Completed pilot *Campylobacter* Grocery Store survey and presented preliminary analysis results.
- Continued to improve estimated of burden of Foodborne illness.
- Continued attribution efforts to estimate the proportion of Foodborne illness caused by specific food commodities.
- Expert consultancies
  - WHO initiative to estimate the global burden of foodborne disease
  - FoodNet-like projects in Canada and Malaysia
- Presented to industry, consumer groups and international visitors

Publications and Abstracts, 2007

A list of FoodNet publications and presentations is also available at the following FoodNet Web site:
http://www.cdc.gov/foodnet/pub.htm

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Further information concerning FoodNet, including previous surveillance reports, *MMWR* articles, and other FoodNet publications, can be obtained by contacting the Enteric Diseases Epidemiology Branch at (404) 639-2206.

Materials Available Online

List of Final FoodNet Surveillance Reports: http://www.cdc.gov/foodnet/reports.htm

CDC. 1998 Final FoodNet Surveillance Report. Atlanta: U.S. Department of Health and Human Services; 1998.
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List of FoodNet *MMWR* articles: http://www.cdc.gov/mmwr/

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List of *FoodNet News* newsletters: http://www.cdc.gov/foodnet/news.htm

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Additional FoodNet publications and presentations are available at:
http://www.cdc.gov/enterics/publications_search.html

Additional information about the pathogens under FoodNet surveillance are available at:
http://www.cdc.gov/foodnet/surveillance_pages/pathogens_conditions.htm
http://www.cdc.gov/ncidod/dbmd/diseaseinfo/foodborneinfections_g.htm

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Listing of Summary Tables and Figures

Page

Bacterial Pathogens